

# SPACE EXPERIMENT MODULE (SEM)

Charles L. Brodell  
NASA Wallops Island Flight Facility  
Mail Code 546.W  
Wallops Island, VA

5/35

## Space Experiment Module (SEM)

The Space Experiment Module (SEM) Program is an education initiative sponsored by the National Aeronautics and Space Administration (NASA) Shuttle Small Payloads Project. The program provides nationwide educational access to space for Kindergarten through University level students. The SEM program focuses on the science of zero-gravity and microgravity. Within the program, NASA provides small containers or "modules" for students to fly experiments on the Space Shuttle. The experiments are created, designed, built, and implemented by students with teacher and/or mentor guidance. Student experiment modules are flown in a "carrier" which resides in the cargo bay of the Space Shuttle. The carrier supplies power to, and the mean to control and collect data from each experiment.

### Overview

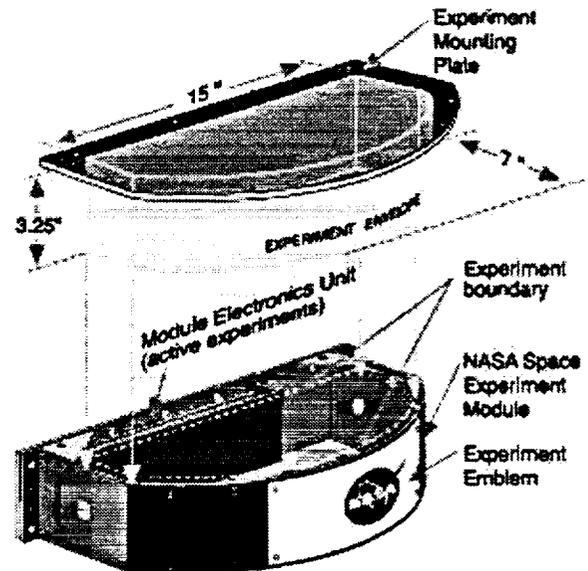
The Space Experiment Module (SEM) Carrier System is a self-contained assembly of engineered subsystems which function together to provide structural support, power, experiment command and data storage capabilities. The carrier system is a five cubic foot 'canister' containing ten experiment modules.

The small, enclosed module (pictured right) can contain approximately 300 cubic inches (4.9 L) of experiment apparatus weighing up to 6 lb. (2.7 Kg.). Experiments may be active (uses carrier supplier power) or passive (non-powered). Students may design active experiments 'on paper' using NASA supplied software and databases. Passive experiments are generally packed in NASA-provided "Space Capsules". Experiment design must adhere to safety standards.

The Space Capsules used to contain passive test articles are clear, sealable polycarbonate vials, 1.0 inch in diameter and 3.0 inches in depth. Space Capsules are packed in special formed foam layers during integration.

The active experiment container uses the "Module Cover" as the Experiment Mounting Plate. The free space available for experiment apparatus in the Module experiment compartment is the "Experiment Envelope". The Envelope is a precisely defined volume outlined on the inboard surface of the Experiment Mounting Plate and extends 3.25 inches below the inboard surface.

The software required for active experimentation is accessible through the World Wide Web [filename semxx.zip (xx is the version number) at the File Transfer Protocol site on <http://sspp.gsfc.nasa.gov>]. The software application helps the experimenter describe the experiment; enter power consumption, parts, materials, and timeline; and



control and command data. The software may be used to analyze the data for SEM compatibility and "post-flight" reports.

The active modules are powered by one 12-Volt battery independent of the Shuttle power supply. Each powered module has an integrated programmable control circuit board or "Module Electronic Unit" (MEU) for data sampling and storage. The MEU processes the student-devised flight operations timeline. A "Ground Module Electronic Unit" is provided to selected active experimenters for development and testing of their active experiment.

Experiments selected to participate will receive a hardware package to support the construction and development of the selected experiment. The hardware package contents are determined by the proposed experiment design.

Experiments are required to be shipped to NASA approximately four months prior to the scheduled flight. The SEM canister is generally installed three months prior to launch in the Space Shuttle cargo bay.

During the early state of the Shuttle flight, astronauts activate the SEM canister via the Payload and General Support Computer. For active experiments (using battery power) the MEU's carry out their unique programmed timeline defined by the experimenter's.

Participation in flight integration and post-flight de-integration is conditional and coordinated through the program. Students and teachers are invited at their expense to attend the launch at Kennedy Space Center.

Following Shuttle spaceflight of the SEM carrier, the experiment hardware or space capsules and the active inflight data from the MEU's is returned to the student experimenters. Experimenters are requested to provide NASA a copy of their post-flight data analysis and reports. NASA archives the results and are available on the website at:

<http://sspp.gsfc.nasa.gov/sem/history/history.html>

Experimenter groups are awarded a "Flight Certificate" which includes a SEM sticker flown on the Shuttle Mission.

## SEM Flight History

A variety of SEM experiments have flown on Shuttle missions since 1996. Students of all ages have enjoyed the experience of exploring the space environment. A history of SEM flight can be viewed at the above website.

SEM-01 STS-80 Space Shuttle Columbia  
Launch date: November 19, 1996

SEM-02 STS-85 Space Shuttle Discovery  
Launch date: August 7, 1997

SEM-03 STS-91 Space Shuttle Discovery  
Launch date: June 2, 1998

SEM-04 STS-95 Space Shuttle Discovery  
Launch date: October 29, 1998

SEM-05 STS-91 Space Shuttle Discovery  
Launch date: June 2, 1998

SEM-06 STS-101 Space Shuttle Atlantis  
**Scheduled for Launch:** December 2, 1999

SEM-07 STS-88 Space Shuttle Endeavor  
Launch date: December 4, 1998

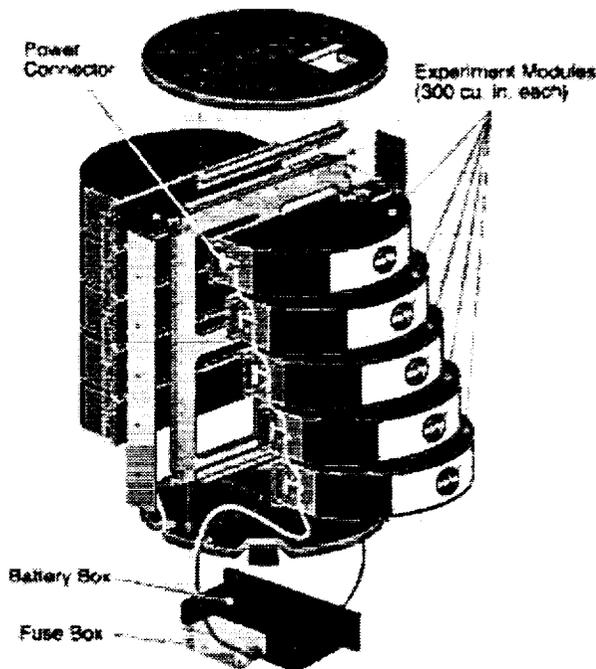
For more information on experiment names and types, that have flown or are scheduled to fly, view the SEM history page at the above web address or the "What's New" section at:

<http://sspp.gsfc.nasa.gov/sem/new.html>

## Getting Started

Submitting a proposal for a SEM experiment offers students an excellent opportunity to explore space and interact with the NASA Space Transportation System (STS) or Space Shuttle program. Instruction for submitting an application can be found in the "How To Participate" section at: <http://sspp.gsfc.nasa.gov/sem>

## SEM Support Structure



*The SEM Support Structure is the structural backbone of the SEM subsystems housed within the GAS canister. It serves as the mounting frame for the Power Subsystem components and ten modules.*

## Additional Information

Applications for participation in the SEM program are accepted on a continuous basis. For additional information or questions, please contact the following:

Charles L. Brodell  
SEM Mission Manager  
Phone: (757)824-1827  
FAX: (757)824-2145  
Charles.L.Brodell.1@  
gsfc.nasa.gov

Barbara Justis  
Technical Liaison  
Phone (757)824-1732  
FAX: (757)824-2145  
Barbara.J.Justis.1@  
gsfc.nasa.gov

For written correspondence, send your request to:

Code 870.W  
Shuttle Small Payloads Project  
Goddard Space Flight Center  
Wallops Island Flight Facility